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# OPERATING EXPERIENCE WITH HIGH-FREQUENCY ELECTRONIC GENERATORS

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For the last 10 or 12 years high-frequency currents have been extensively employed in heat treatment of steel products. As compared with heating in electric furnaces and salt baths, this method saves electric power, reduces machine processing, makes it possible to carry out heat treatment on the production line, and improves working conditions.

Our industry is manufacturing two basic types of electronic generators for smelting and hardening: the G and GEL types. Both generators have two G-431 tubes operating in parallel.

All GZ-47 type generators in the Verkhne-Sergino Plant were changed over to single-tube operation. It had been discovered that with two tubes they would stop operating because of the excessively high equivalent circuit resistance. Operation on a single tube provided sufficient power for heat treating the specified parts. This change also resulted in a reserve stock of generator tubes.

TVCh (high-frequency current) electronic generators of the GLE-61A type made by the Leningrad "Elektrik" Plant for steel smelting were also installed in the above-mentioned plant. Barrel-shaped KB-10 ceramic capacitors were installed by the manufacturing plant in the furnace oscillating circuit and driver circuit. The capacitance of each capacitor was not greater than 35 mmfd nor less than 25 mmfd. The total capacitance of the furnace circuit was 24,000 mmfd and total capacitance of the driver circuit was 4,500 mmfd.



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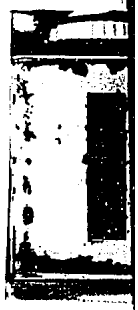

Both oscillating circuits were designed to operate at a voltage of 10 kv. However, sparkover took place across the capacitors at this voltage. To eliminate this condition the operating voltage was decreased to 5 kv.

At 5 kv the performance of the capacitors was more stable, but some of them continued to break down (80 in the course of a month). Moreover, the capacitor bank heated up to 60 or 70° C during operation.

The brigade which conducted experiments on the spot in adjusting the TVCh generators, suggested manufacturing air capacitors which would require 68 cu m of space. Because of the high cost of manufacturing air capacitors, the plant refused to make them and continued operations at 5 kv in spite of the great number of capacitor breakdowns.

After investigation by the plant electrical measurements laboratory, it was decided that the cause of the poor performance of the capacitors was their rough and hydroscopic surfaces which readily collected dust and moisture, thereby facilitating sparkover on the ceramic surface.

Polishing the surface increased the stability of the capacitors but involved a great deal of work without producing equivalent results.

An alternative was then tried. The ceramic part of the capacitor was carefully washed with acetone, dried at a temperature of 65° and covered with a fine layer of an alcoholic solution of shellac. After this layer had dried, a coat of thicker shellac was applied, thus forming a glossy insulating film over the hydroscopic surface of the capacitor. Thereafter the capacitors held up satisfactorily under 30 kv voltage tests at power frequency and also gave good results at high frequencies under 10 kv voltage.

All the other capacitors were then coated with shellac. The generators were switched over to 10 kv operation. No sparkovers were noted in the course of a year. Capacitor heating dropped abruptly, since the surface leakage had been eliminated by lacquering. Smelting time was reduced from 90 min to 18-20 min. Power consumption for smelting dropped from 54 to 21 kw-h. This corresponds to a drop in power consumption from 21.8 to 9.8 kw-h per kilogram of molten metal. The productivity of the workshop as a whole was seven times greater.

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